Premier 2-4-1A Mountain Steam Locomotive

OPERATOR'S MANUAL

Compatibility

This engine is available in 2-Rail and 3-Rail versions and will operate on any traditional O-54 Gauge 3-Rail track system. Or any 54" radius 2-Rail track system. It is also compatible with most standard AC transformers and DC power packs. (See pages 42 and 43 for a complete list of compatible AC transformers and DC power packs.

Passenger Station Announcement

PLEASE READ BEFORE USE AND SAVE

Table of Contents

Configuring Locomotive for 2-Rail or 3-Rail Operation. 3
Installing/Removing Pickup Rollers. 3
Configuring for 2-Rail or 3-Rail Power Input 3
DCS or DCC 4
Installation of Smoke Deflectors 4
Proper Coupler Selection 5

Set Up Checklist. 8
Placing the Engine on the Track 8

PS 3.0 Enhancements. 9
Conventional AC/DC Start-up/Shut-down. 9
DCS/DCC Switch. 9
Programming Track (for DCC operation). 9
Loading DSP and/or Boiler Firmware. 10
LED Lighting. 10

Modes of Operation. 10
Conventional AC Operation. 10
Conventional DC Operation. 11
DCC / Digital Command Control. 12
F3 Start up / Shut Down. 13
Sounds. 13
Lights. 14
Master Volume. 14
Couplers. 14
Forward/Reverse Signal. 14
Smoke (If Equipped). 15
Crossing Signal. 15
Cv29. 15
Long and Short Addressing. 16
Feature/Factory Resetting. 17

M.T.H. Proto-Sound 3.0 Expanded HO DCC Functionality. 18
Advanced DCC Operation. 18
Additional F Functions. 18
Configuration Variables. 20
Advanced Consisting. 24
Programming Track. 28

Proto-Sound® 3.0 Operating Instructions. 30
Activating Proto-Sound® 3.0 Conventional Mode Features. 30
PSA/FYS 32
Proto-Coupler™ Operation 33
Speed Control 34
Locking Locomotive Into A Direction 34
Reset To Factory Default 35
Automatic Sound Effects 35

Maintenance. 36
Lubricating and Greasing Instructions 36
Cleaning The Wheels, Tires and Track 37
Traction Tire Replacement Instructions 37
ProtoSmoke™ Unit Operation 38
Troubleshooting Proto-Sound® 3.0 Problems 40
Transformer Compatibility and Wiring Chart 42
DC Power Supply Chart 43
Additional Features Accessible Of DCS Remote Control System 44
Service & Warranty Information 45
Limited One-Year Warranty 45

CAUTION: ELECTRICALLY OPERATED PRODUCT:
Recommended for Ages 14 and up. Not recommended for children under 14 years of age without adult supervision. As with all electric products, precautions should be observed during handling and use to prevent electric shock.

WARNING: When using electrical products, basic safety precautions should be observed, including the following:
Read this manual thoroughly before using this device.

- M.T.H. recommends that all users and persons supervising use examine the hobby transformer and other electronic equipment periodically for conditions that may result in the risk of fire, electric shock, or injury to persons, such as damage to the primary cord, plug blades, housing, output jacks or other parts. In the event such conditions exist, the train set should not be used until properly repaired.
- Do not operate your layout unattended. Obstructed accessories or stalled trains may overheat, resulting in damage to your layout.
- This train set is intended for indoor use. Do not use if water is present. Serious injury or fatality may result.
- Do not operate the hobby transformer with damaged cord, plug, switches, buttons or case.

This product may be protected by one or more of the following patents: 6,019,289; 6,280,278; 6,281,606; 6,291,263; 6,457,681; 6,491,263; 6,604,641; 6,619,594; 6,624,537; 6,655,640.

©2011, M.T.H. Electric Trains®, Columbia, MD 21046

Configuring Locomotive for 2-Rail or 3-Rail Operation

Installing/Removing 3-Rail Pickup Rollers

Both 2-Rail and 3-Rail versions of this locomotive can be configured to operate on either 2-rail or 3-rail track by removing or adding the center rail pickups. 3-rail track operation requires the pickups, 2-rail track operation does not. The pickups are factory installed on 3-rail versions and packaged separately in the locomotive box for 2-rail versions. Each pickup roller installs with a single Phillips screw seen in Figure 1.

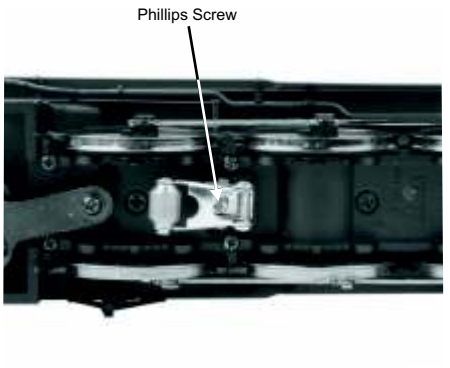


Figure 1: 3-Rail Pickups installed with a single Phillips Screw

Configuring for 2-Rail or 3-Rail Power Input

Once you have configured the engine for 2-rail or 3-rail operation, you must manually select the power input switch located in the first tender top hatch for 2-rail operation as seen in Figure 2.

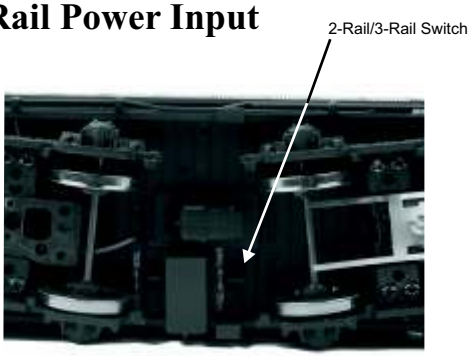


Figure 2: Selecting 2-rail or 3-rail power input setting

DCS or DCC

If you are operating with command control you must set the selector switch to DCC for DCC operation and DCS for DCS operation. Refer to page 9 to see and learn about the differences.

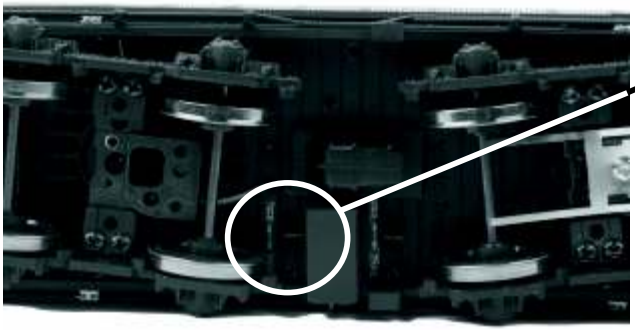


Figure 3: DCS/DCC Switch

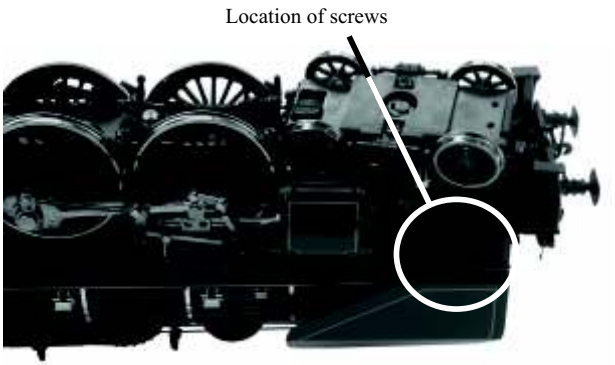
CAUTION:

Do not apply DCS signals and DCC signals to the same track simultaneously. The signals are not compatible, mixing the DCS and DCC signals will damage the DCS TIU unit.

Smoke Deflector Installation

The smoke deflectors are supplied in the package to prevent damage in shipping. The smoke deflectors are marked L for the left side and R for the right side and are easily installed with the supplied screws.

Insert the tab at the end of the support into the slot on the inner side of the smoke deflector. Then align the holes in the base of the smoke deflector with the holes in the running boards and insert the supplied screws from the under side of the running board.



Coupler Systems

The Chapelon Pacific is packaged with 4 different coupling systems.

- European Fine Scale Coupler System
- MTH Remote-Controlled Proto Coupler
- Ace Trains compatible coupler
- Kadee type mounting bracket (Scale Wheel versions only)(Couplers not provided)

Coupling Systems

All versions have the European Fine Scale Coupler mounted on the front pilot beam.

Two tender pilot beams are provided. One is for use with the European Fine Scale Coupler. The other pilot is used for the MTH Proto-Coupler, The ACE Trains type coupler and the Kadee type coupler

All versions have an ACE Trains type coupler in the packaging that can mounted on the tender truck.

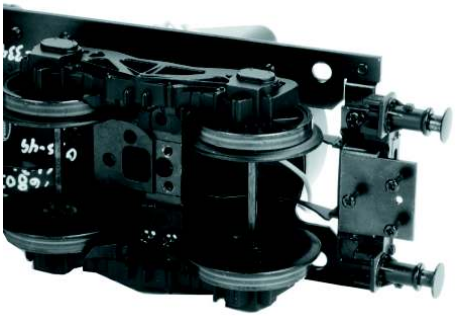
The Scale Wheeled Tender has the European Fine Scale Coupler mounted on the rear pilot beam. An M.T.H. Remote-Control Proto Coupler is provided in the packaging along with the an 2nd Pilot Beam that is required to install the coil coupler. In addition a mounting bracket is supplied for mounting a Kadee style coupler on the tender.

The Hi-rail Wheeled Tender has an MTH Remote Controlled Proto Coupler mounted on the rear tender truck. A European Fine Scale Coupler is provided in the packaging along with correct pilot beam need to mount the European Fine Scale Coupler.

To remove or install the MTH Remote-Controlled Proto Coupler the tender shell must be removed to unplug or connect the coupler control wires to the Proto Coupler.

European Fine Scale Coupler

Optional Tender Couplers



Kadee® Coupler Bracket Installed

Ace Trains Coupler

Remote Controlled Proto-Coupler

Proto-Coupler Installation

Owners of 2-rail models who intend to run this locomotive on a 3-rail layout may wish to use the M.T.H. Proto-Coupler so that they may enjoy the remote uncoupling anywhere on the layout.
A Proto-Coupler and the necessary mounting hardware are included in the packaging with each 2-rail locomotive. The wire harness in the tender is prewired with a plug-in connection for the Proto-Coupler.
To install the Proto-Coupler on a 2-rail tender, follow the step by step instruction listed below.

- First remove the Fine Scale European Coupler and pilot beam from the bottom of the tender chassis.
- Install the optional pilot beam with no coupler installed
- Next remove the shell from the tender by removing the 4 body screws and then unplug the wire harness between the shell and the chassis.

- Attach the proto-coupler to rear tender truck as shown.

- Plug the Proto-Coupler to the black connector provided.

- Reconnect the wire harness between the tender chassis and the tender shell.

- Reattach the tender shell. Remember that the front step piece goes under the chassis.

When power is applied to the engine the Proto-Coupler can be operated anywhere on the layout. To operate the coupler in the command mode, press the rear coupler button on the DCS remote each time you want the coupler to open.

To operate the coupler in the conventional mode, the coupler can be opened by quickly pressing the Bell Button and Horn Button (1 Bell and 3 Horns) on a Z-4000 or compatible Toy Train Transformer. Refer to the Proto-Sound 3.0 Operating Instructions on page 19.

Placing The Engine On The Track

Your MTH steam engine is equipped with a tetherless drawbar. There is no unsightly cable or box showing between the engine and the tender to detract from the appearance of the model. The electrical connections pass through conductors in the drawbar, so it is important that the connector be properly inserted. The connector is fixed to the rear end of the drawbar. The mating connector is attached to a swivel connection on the front of the tender frame. The drawbar is connected to the engine chassis with a screw and should not need any attention.

In order to mate the connectors of the drawbar and the tender, place the engine and the tender on the track. Position the tender over the drawbar connector and insert the drawbar pin on the swivel connector into the hole in the drawbar.

Now grasp the tender with both hands as shown below (in Fig. 8) and place a finger on each side of the drawbar near the connector. Now using your fingers, push the connectors together. The connector will make a slight click when it is properly seated(in Fig. 9). At this point you are ready to begin operating your engine.

Fig. 8: Pushing Connectors Together

Fig. 9: Connected Engine and Tender

To disconnect the engine and tender apply downward pressure near the tender until the connectors separate.

The drawbar is able to withstand a 90 degree twist such as might be experienced in a derailment where the engine or the tender would turn over and the other unit would remain upright.

If the drawbar is not properly connected your engine may exhibit erratic or no operation. If this happens turn off the track power and make sure that the drawbar connectors are properly seated. Then reapply power to the track and continue operation.

PS 3.0 Enhancements

Here are some of the exciting changes incorporated into your new MTH Proto-Sound® 3.0 Locomotives. More advanced features such as Custom Speed Tables and Advanced Consisting can be found in the DCC section of this manual.

Conventional (Analog) AC/DC Start-up/Shut-down

Your new MTH PS3.0-equipped locomotive no longer has batteries. It uses Super Capacitors to hold the engine board alive for a short time when you shut off or interrupt track power. Because of this, when you first apply track power to your PS3.0-equipped O Gauge engine, you will notice the headlight comes on but nothing else. This is perfectly normal. The capacitors are charging up during this time. The wait time depends upon how long it's been since you last applied power to the engine. Typically it will take 1-15 seconds to fully charge. **NOTE: The 1-15 second charging wait time ONLY applies to conventional AC track power.**

Once the headlight shuts off, the engine will play its start-up sounds and all the lights will come back on, simultaneously. Smoke too if you have it turned on.

The capacitors hold enough charge to play the full shut-down sounds. Also, the capacitors allow you to operate your engine in conventional mode just like you would any other conventionally-controlled engine. Finally, because there are no batteries, you will notice there is no external charge jack on the engine.

DCS/DCC Switch

Your MTH PS3.0-equipped engine has a DCS/DCC selector switch (located on the underside of the tender in steam engines). To operate the engine in DCS mode, ensure the switch is set to DCS. If you wish to run the engine in DCC mode, ensure the switch is set to DCC.

If you inadvertently leave the switch in DCC it won't hurt anything, you just won't be able to communicate with your engine with your DCS system. Likewise, if you leave the switch in DCS and try to operate the engine under DCC you may notice a humming coming from your engine and you will likely notice that your DCC system's overload light will be on.

Programming Track (for DCC operation)

Your MTH PS3.0-equipped O Gauge engine can function on Programming Track outputs from DCC systems. Most DCC systems can support the current requirements of the engine as long as it's not started up. If you plan on powering up the MTH engine on your programming track, you may want to consider a DCC Programming Track Booster.

Loading Tender and/or Boiler Firmware

Your new MTH PS3.0-equipped O-Gauge engine affords you the ability to load DSP firmware. Additionally, in steam engines you can load boiler firmware. Loader version 2.20 or later will allow you to do this. Please refer to the Loader program's instructions for more details. So, as MTH releases new features or updates you will be able to take full advantage without having to ship your favorite engine anywhere. All new updates are available on our website. MTH will make announcements as they are available. Not all updates will apply to all engines. **NOTE: Requires a TIU w/ version 4.20 or later firmware, and requires loader version 2.20 or later.**

LED Lighting

Gone are the incandescent bulbs. Your new PS3.0-equipped engine has LED lighting. MTH uses various colored LEDs to simulate the correct lighting on your engines from the warm, yellow-orange colored light coming out of an old lantern on your favorite steam engine to the high-intensity halogen lamp on the latest modern diesels, LED's allow for various, correct colors. Also, they require less power and do not emit as much heat as incandescent bulbs.

Modes of Operation

There are 4 options for operating your MTH Proto-Sound® 3.0-equipped engine;

-Conventional AC
-Conventional DC
-DCS - MTH Digital Command System
-DCC

When the locomotive is placed on the track and power is applied to the track the locomotive will detect the type of control system being used and respond accordingly. Below is an overview of the 4 different systems.

NOTE: You'll need to have the DCC/DCS switch set correctly if your using one of those two modes.

Conventional AC Operation

When using conventional AC power, the engine will respond to changes in track voltage. An increase in track voltage will increase the locomotive speed and a reduction in track voltage will reduce the engine speed.
A short interruption (approximately 1 to 2 seconds) in the track voltage will cause the engine to cycle in the sequence for each track voltage interruption (neutral – forward – neutral – reverse)

When power is first applied to the track, the locomotive will be silent for a few seconds until the super capacitors are charged (The super capacitors provide power to the sound system during direction changes or intermittent drops in track power due to dirty track on or switches, when operating in conventional mode). When the super capacitors are charged, all the lights will come on and the engine sounds will start up. There should be no movement, as the engine is in neutral. Causing a short interruption of track power by using the direction button on the transformer, or by turning the throttle off and then back on again, will change the sequence to the forward state. Then increasing the throttle will begin to move the engine forward, and speed will increase as the throttle is advanced.

If there is another interruption in track power the sequence will change to the neutral position again. The engine will remain in the neutral state until there is another interruption in track power. The next interruption in track power will move the sequence to the reverse state. The engine will now move in the reverse direction. If the power interruption was accomplished by using the direction button and the throttle position was not changed, the engine will run in the reverse direction at the same speed that it was traveling in the forward position.

Subsequent interruptions in track power of 1-2 seconds will continue the sequence rotation. If you happen to interrupt track power for longer than about 2 seconds, the engine will begin its shut down sounds. If this occurs you can cycle the direction sequence again to get back to the direction you wish to move and once the engine starts moving its shut down sounds will stop playing.

In conventional AC operation the whistle sound, the bell sound, PFA sounds and other operational functions can be accessed if your transformer has a horn/whistle button and a bell button. By using combinations of button presses, different commands besides blowing the whistle and ringing the bell can be initiated.

See page 14 for activating Conventional AC Features

Conventional DC Operation

Your MTH locomotive will operate on conventional DC track voltage also. However, functions such as blowing the whistle, ringing the bell, and the PSA sounds cannot be initiated in conventional DC. Only the steam chuffing sounds with synchronized puffing smoke, squealing brake sounds, and idle sounds will function.

Operation of your MTH Proto-Sound 3.0 engine in conventional DC is very similar to operating a conventional AC engine. As you increase track voltage, engine speed increases.
As the track voltage is decreased, engine speed is decreased. When track voltage polarity is reversed using the direction button on the power pack, the engine will run in the opposite direction. The electronics in your MTH Proto-Sound 3.0 locomotive are designed to slowly change direction without a need to change the throttle, if you so desire.

Just change the polarity switch on your DC power pack and the engine will gradually come to a stop and then automatically begin traveling in the opposite direction. The speed will build up to the same speed that the engine was going in the previous direction.

When power is first applied to the locomotive, the engine's sounds will start up when the track voltage reaches about 8 VDC. To get your locomotive moving, after the startup sounds have finished and the locomotive is idling, slowly increase the track voltage until the locomotive is traveling at the desired speed.

DCC - Digital Command Control

DCC is a popular digital command scheme wherein the track power is also a digital control signal. That is, using a DCC controller, you can communicate with multiple engines and have all of them moving at different speeds and in varying directions on the same track at the same time. The power/command signal remains constant and engines are commanded to perform as desired. Your MTH PS3.0-equipped engine has the ability to decode and respond to these DCC commands. This allows you to mix and match MTH PS3—equipped engines as well as operate them with any other manufacturer's DCC-decoder equipped engine. The best part about your MTH PS3.0-equipped engine is that the decoder is built right in. No need to remove the hood and install speakers or boards. It's all done for you at the factory. Each PS3.0-equipped engine has a full complement of lights, sounds, smoke (if equipped). Just set the model on the rails, apply DCC power and hit F3 on your DCC handheld controller and you're off and running.

Basic DCC Operation:

Your MTH PS3.0-equipped engine takes full advantage of DCC's capabilities. Below are the basic commands you'll want to know to get started running quickly. Please refer to the Advanced DCC Operation section of the manual if you want to dig into the full capability of DCC.
Each engine type may have a slightly different F Function list. This depends upon whether it's steam, diesel, or electric and whether it has smoke or not. Please refer to the table of Default CV Values for your particular engine's F Functions.
A note about enabling/disabling F Functions in DCC - Depending upon the DCC system you have you may need to toggle a particular F Function on then off to actually get it to enable. Some DCC systems do this for you automatically and others allow you to set particular F Function buttons to either be set for momentary or toggle. Please refer to your DCC control station manufacturer's manual for more information on how they handle F Function buttons.

Your MTH PS3.0-equipped engine's default short address is 3. So all you have to do is power up your DCC system and call up Locomotive 3 to begin.

Start-Up/Shut-Down

F3 – Pressing this twice (toggle on then off) will start up your engine. When you apply DCC power your MTH PS3.0-equipped engine will remain dark and quiet. Since you likely don't want to run the engine this way, simply press F3 twice to start your engine. The lights, sound and smoke (if equipped) will come on.
Note – You are actually able to move the engine in DCC without starting it up. Just increasing the throttle will cause the engine to move. In order for F3 to function correctly the engine must NOT be moving
To shut your engine down, press the F3 button twice. This will play the shut down sounds and then turn the lights and smoke and sounds off. As long as there is DCC power still on the track the engine can be started up again by pressing the F3 button twice.

Bell/Whistle (Horn)

F1 – Bell. To activate the Bell press F1. To deactivate it, hit F1 again
F2 – Whistle (Horn). To activate the Whistle/Horn, press F2. To shut it off either let off the F2 button or press and release it

PFA

F4 – PFA. PFA in MTH lingo stands for **P**assenger/**F**reight **A**nnouncements. Your engine is pre-programmed for the appropriate type of sounds based upon the type of service the real-life engine used in daily operation.
There are five sound sequences or segments in the PFA feature. Each segment is advanced by you, the operator. You hit the Direction button on the DCC controller to let the engine know you want it to advance. In most PFA sequences there is a minimum wait time of about 10 seconds before it will advance. So, here is how a typical PFA sequence operates:
1. Press the F4 button twice (toggle F4 on then off) to start the PFA sequence on the engine. You'll hear “Now arriving…”
2. Press the F4 button twice (toggle F4 on then off) again to stop the engine at the station. It is recommended to do it this way rather than bring the engine to a stop with the throttle since PFA allows automatic departure (movement) of the engine after the last F4 toggle. You'll hear the engine sounds switch from the cab to the station with all the ambient station sounds you'd hear in the real thing

3. Press the F4 button twice (toggle F4 on then off) again to advance the sequence. You'll hear “Now boarding…”
4. Press the F4 button twice (toggle F4 on then off) again to advance the sequence. You'll hear “Now departing…”
5. Press the F4 button twice (toggle F4 on then off) the last time to advance the sequence. You'll hear “All aboard…” the engine sounds will switch over to the cab again and the engine will pull away at the same speed it entered the station. For a few seconds the bell will ring as it's departing the station

Note – In order to maximize the realism, we recommend that you reduce the engine's speed to a slow pace just prior to hitting the F4 button the first time (to activate PFA)

Lights

F5 – Lights. This toggles all your lights (except the headlight) on and off

Master Volume

F6 – Master Volume. There are 10 volume levels. Pressing F6 twice (toggling on then off) raises the Master Volume one level. The Master Volume loops. That is, if you go past the 10th level it will loop back around to the 1st or lowest volume level.

Couplers

Your MTH PS3.0-equipped engine comes with remotely controlled Proto-Couplers. They can be fired using your DCC handheld.

F7 – Rear Coupler. Pressing F7 twice (toggling on then off) will fire your Rear Coupler

Forward/Reverse Signal

Just like a real engine, you can announce the direction of travel using your DCC handheld and F9 and F10.

F8 – Forward Signal. Pressing F8 twice (toggling on then off) will sound the Forward Signal. This is two whistle/horn blasts

F9 – Reverse Signal. Pressing F9 twice (toggling on then off) will sound the Reverse Signal. This is three whistle/horn blasts

Smoke (if equipped)

You can control PS3.0-equipped engines that have smoke by toggling F10 on or off. You can also adjust the smoke output using F11. Some engines have a switch to enable/disable smoke and others have a smoke volume pot. In the case of a switch, ensure the switch is set to ON and in the case of a smoke volume pot, ensure the pot is turned fully clockwise to enable smoke operation in DCC.

F10 – Smoke On/Off. Enabling F10 will turn the smoke unit on. Disabling F10 will turn your smoke unit off.

F11 – Smoke Volume. There are three smoke volume levels in your MTH PS3.0-equipped engine – Low/Med/High. The default for this is set to High. You can adjust the smoke output (amount of smoke the generator puts out) by pressing the F11 button twice. This sets the level to the next step. For example, if you are currently at the High smoke output level, pressing F11 twice (toggling it on then off) will set the smoke volume to Low. Pressing F11 twice again will set it to Medium and so on.

Crossing Signal

Again, just like a real engine, you can trigger the Crossing Signal on your engine. This is two long, one short, one long whistle/horn blast.

F12 – Crossing Signal. Pressing F12 twice (toggling on then off) will sound your Crossing Signal.

Engine Sounds – F18. You can turn the Engine Sounds On/Off by pressing the F18 button. Pressing it once (enabling F18) will cause the Engine Sounds to shut off. The Whistle/Horn and Bell sounds will still be active, however. To turn the engine sounds back on press the F18 button again (disable F18).

CV29

CV29 is the basic decoder setup CV that is used by all DCC decoder manufactures. So, if you are familiar with CV29 from other manufacturer's decoders MTH's is no different. The most important part of CV29 is the ability to switch between long and short addressing. By default, CV29 on your MTH PS3.0-equipped engine is set to 2.

Long and Short Addressing

Like most DCC Decoders, your MTH PS3.0-equipped engine can be programmed with both Long and Short Address. Short addresses are those from 1-127 and Long addresses are those from 128-9999. You can program the engine address either with Programming on the Main (PoM) or using a Programming Track. Since it's easiest, in most cases, to PoM the instructions will show you how to do it this way.
By default, your MTH PS3.0-equipped engine comes programmed with both a long and short DCC address. The default Short address is always 3. **The default Long address will either be the cab number (if the engine's cab number is 128 or higher) or it will be 3333.**

To change your engine's Short Address using PoM:

1. Call up the engine's current address on your DCC handheld

2. Enter Programming on the Main on your DCC handheld

3. Enter the new address you want – Remember you can only use address 1-127 for Short Addressing

4. Once you hit Enter the engine will give you a two whistle/horn blast response

5. Call up the engine on its new address and away you go

Alternatively, depending upon the type of DCC system you have, you can enter PoM and then write the new address in the Address Menu. This only works for short addressing. For example, on an MRC Prodigy Advance2 system, you would:

1. Call up the engine's current address on your DCC handheld

2. Hit the PROG button twice to enter PoM mode

3. Hit Enter twice so the LCD displays “Adr”

4. Type in the new Short Address (1-127) that you want and hit Enter

5. The engine will give you a two whistle/horn blast response

To change your engine's Long Address using PoM:

1. Call up the current engine's address on your DCC handheld

2. Enter Programming on the Main on your DCC handheld

3. In this step you have to tell the MTH engine that you want it to start looking at long addresses. You do this in Cv29:

    a. Bring up the CV menu on your DCC handheld
    b. Enter"29" to edit CV29
    c. Enter "36" to change the value of CV29 and hit Enter
    d. The engine will give you a two whistle/horn blast response

4. In the following steps you will now need to write values to CV17 and CV18 to tell the engine what the long address should be

Feature/Factory Resetting

If all else fails and you aren't sure of something, never fear. You can always get your engine back to a known state by either performing a Feature or Factory Reset.

There are a couple of ways to reset your MTH PS3.0-equipped engine:

? Factory Resets – Clears everything – takes engine to just like it was when you got it brand new
    - Send a decimal 08 to CV 8 to reset everything entirely back to factory default
    - Send a decimal 192 to reset everything except user speed tables

? Feature Resets – There are a couple of Feature Resets that you can use
    - Press F21 twice (toggling on then off). This resets the smoke, volume and lights back to their defaults
    - Send a decimal 64 for a Feature Reset. This resets volumes, smoke and light settings.
    - Send a decimal 128 to reset only address values back to factory default

?
    - This is the same as writing 55 to CV55 to engine address 55

MTH PS3.0 Expanded HO DCC Functionality

Advanced DCC Operation:

This section of the manual provides more in-depth detail on how to set up and configure your MTH PS3.0-equipped engine using the NMRA-standard CV's as well as the manufacturer-specific CV's. It also explains some of the other F Functions not covered in the Basic DCC Operation section.

Additional F Functions

Idle Sequence - F22-F25. Pressing F22, F23, F24, or F25 twice (toggling on then off) will trigger an Idle Sequence if the engine is not moving. These vary from engine to engine and may include things like checking the coal load, checking the water level, using the Alemite grease gun on the drivers, etc. When triggered, these will run through the sequence that varies in duration.

Note – The engine must be sitting still in order to trigger these

Coupler Slack – F13. When an engine hooks up and pulls a train it has to take up the coupler slack. You can play this sound by pressing F13 twice (toggling on then off). This feature works two ways – While the engine is sitting still, press F13 twice to enable it.

Then, when you move the engine, it will play the Coupler Slack sound. The second way is to simply force the sound while the engine is moving. To do this, simply press F13 twice (toggling it on then off). The sound will play.

Extended Start-Up – F14. If your engine is shut down or you've just applied DCC power pressing F14 twice (toggling it on then off) will start the Extended Start-Up sounds. This is very similar to F3 except you will hear the crew talking back and forth about getting the engine ready to run.

Extended Shut-Down – F15. If your engine is already up and running you can play the Extended Shut Down sounds by pressing F15 twice (toggling on then off). The Extended Shut Down is very similar to F3 in that the engine will ultimately shut down but in the case of Extended Shut Down you will hear the crew talking back and forth about how the engine ran, time schedules, etc.

Rev Up/Labor Chuff – F16. Depending upon the engine type you have Diesel/Electric or steam you can either force the engine to Rev Up (Diesel/Electric) or force the engine to play its Labor Chuff sounds. For a Diesel/Electric, press the F16 button twice (toggling on then off) to Rev Up one notch. There are eight rev levels in a Diesel/Electric.

To force the Labor Chuff sound in a steam engine, press the F16 button once (enable F16). As long as F16 is enabled the engine will play its Labor Chuff sounds. To set the sound back to Normal Chuff press the F16 button again (disable F16).

Rev Down/Drift Chuff – F17. Depending upon the engine type you have Diesel/Electric or steam you can either force the engine to Rev Down (Diesel/Electric) or force the engine to play its Drift Chuff sounds. For a Diesel/Electric, press the F17 button twice (toggling on then off) to Rev Down one notch. There are eight rev levels in a Diesel/Electric.

To force the Drift Chuff sound in a steam engine, press the F19 button once (enable F17). As long as F17 is enabled the engine will play its Drift Chuff sounds. To set the sound back to Normal Chuff press the F17 button again (disable F17).

For example, if you set the rev level on a Diesel to notch 6 and start increasing the speed of the engine it will stay at that rev level until the engine's speed calls for a higher rev level. Once the engine has gone past that rev level, notch 6 in this example, the engine will then rev down normally, all the way to idle, as you decrease the speed.

Single Whistle/Horn Blast – F19. To play a Single Horn Blast press the F19 button twice (toggling in on then off). This plays a single, short horn blast.

Coupler Close – F20. To play the Coupler Close sound press the F20 button twice (toggling it on then off). You can play this sound as you're coupling cars together to add realism.

One Shot Doppler – F26. You can set your MTH PS3.0-equipped engine to simulate the actual Doppler Effect sound a real engine makes as it passes you. To do this, press the F26 button once (enable F26) and then listen as the engine makes that pitch shift that mimics the Doppler Effect perfectly. Press the F26 button again (disable F26) to shut off the Doppler Effect. With a little practice in timing and speed you can make this happen right in front of you.

Brake Sounds – F27. Pressing the F27 button (enable F27) will disable the Brake Sounds for your engine. The Brake Sounds occur when you reduce the speed of your engine rapidly. To enable the Brake Sounds press the F27 button (disable F27). Brake Sounds are On by default.

Cab Chatter – F28. Cab Chatter occurs when the engine is sitting at idle. There are various times when the crew will talk to each other when the engine is sitting at idle. Pressing the F28 button (enable F28) will disable the Cab Chatter. Pressing the F28 button again (disable F28) will enable Cab Chatter. Cab Chatter is On by default.

Configuration Variables (CV)

Configuration Variables used on MTH PS3.0-equppied engines.

CV1	Short Address: 1-127 are the valid addresses
CV2	Start Voltage (CV52, bit0 must =1. This will enable PWM Mode)
CV3	Acceleration Rate (CV52, bit0 must =1. This will enable PWM Mode)
CV4	Deceleration Rate ((CV52, bit0 must =1. This will enable PWM Mode)
CV5	Max Voltage (CV52, bit0 must =1. This will enable PWM Mode)
CV8	MFG ID. MTH =27. Also used for various resets
CV17	High Byte of Extended Address
CV18	Low Byte of Extended Address
CV19	Consist Address (bit 7=1 on an engine will tell the engine it's reversed in a consist)
CV21	Defines active Function F1-F8 for the active consist
CV22	Defines active functions for FL and F9-F12 for the active consist (bit 0=1 will tell an engine that you want it's FL control to operate under the consist address – bit1-0/bit2=1 will configure the FL control for a reversed engine in a consist)
CV23	Consist Acceleration Rate
CV24	Consist Deceleration Adjustment
CV25	Speed Table Select
CV29	Decoder Configuration
CV52	MTH PWM Mode Configuration
CV53	MTH Acceleration (1/8*sMPH/s). For example – a Value of 8 written would give you 1sMPH/s acceleration
CV54	MTH Deceleration Rate (1/8*sMPH/s)
CV55	Factory Reset Alternate method: Send a value of 55 to CV55 on address 55 and the model will go back to Factory Default
CV63	MTH Consist Acceleration Rate (1/8*sMPH/s)
CV64	MTH Consist Deceleration Rate (1/8*sMPH/s)
CV66	Forward Trim (CV52, bit0 must =1. This will enable PWM Mode)
CV67-CV94	Speed Table Selection (CV29 bit 4 must be set to 1 then CV25 must be set to 0 or 1)
CV95	Reverse trim (CV52, bit0 must =1. This will enable PWM Mode)
CV105	User ID #1 – General Purpose use for customer
CV106	User ID #2 – General Purpose use for customer
CV115-CV170	MTH Function Assignments – See table of supported CV's and manual section on how to re-arrange them for further information

Below is the table of Factory Default MTH supported DCC CV's. This table is specific to the engine in the title of this manual:

Factory Default Values for MTH PS3.0 DCC Configuration Variables (CV's)

CV	Default Value		Description	Function	CV	Default Value		Description	Function
	Decimal	Hex		Key		Decimal	Hex		Key
1	3	03	Short Address	-	117			Function - Horn High Byte	2
2	10	10	Start Voltage (CV52 bit 0 must = 1)	-	118			Function - Horn Low Byte	2
3	0	0	Accel Adjustment	-	119			Function - Start-Up/Shut Down High Byte	3
4	0	0	Decel Adjustment	-	120			Function - Start-Up/Shut Down Low Byte	3
5	0	0	Max Voltage (CV52 bit 0 must = 1)	-	121			Function - PFA High Byte	4
7	0	0	NMRA Mfg Version	-	122			Function - PFA Low Byte	4
8	0	0	NMRA Mfg ID	-	123			Function - Lights High Byte	5
17	192	C0	Extended Address High Byte	-	124			Function - Lights Low Byte	5
18	0	00	Extended Address Low Byte	-	125			Function - Master Volume High Byte	6
19	0	00	Consist Address	-	126			Function - Master Volume Low Byte	6
21	0	00	Consist Functions F1-F8	-	127			Function - Rear Coupler High Byte	7
22	0	00	Consist Functions F9-F12	-	128			Function - Rear Coupler Low Byte	7
23	0	00	Consist Acceleration Adjustment	-	129			Function - Forward Signal High Byte	8
24	0	00	Consist Deceleration Adjustment	-	130			Function - Forward Signal Low Byte	8
25	0	00	Speed Table Select	-	131			Function - Reverse Signal High Byte	9
29	2	02	Decoder Configuration	-	132			Function - Reverse Signal Low Byte	9
52	0	00	MTH PWM Motor Configuration	-	133			Function - Smoke On/Off High Byte	10
53	128	80	MTH Acceleration Rate	-	134			Function - Smoke On/Off Low Byte	10
54	64	40	MTH Deceleration Rate	-	135			Function - Smoke Volume High Byte	11
63	0	00	MTH Consist Acceleration Rate	-	136			Function - Smoke Volume Low Byte	11
64	0	00	MTH Consist Deceleration Rate	-	137			Function - Crossing Signal High Byte	12
66	0	00	Forward Trim	-	138			Function - Crossing Signal Low Byte	12
67	0	0	Alternate Speed Curve Step 1	-	139			Function - Coupler Slack High Byte	13
68	9	9	Alternate Speed Curve Step 2	-	140			Function - Coupler Slack Low Byte	13
69	19	13	Alternate Speed Curve Step 3	-	141			Function - Ext Start Up High Byte	14
70	28	1C	Alternate Speed Curve Step 4	-	142			Function - Ext Start Up Low Byte	14
71	38	26	Alternate Speed Curve Step 5	-	143			Function - Ext Shut Down High Byte	15
72	47	2F	Alternate Speed Curve Step 6	-	144			Function - Ext Shut Down Low Byte	15
73	57	39	Alternate Speed Curve Step 7	-	145			Function - Labor Chuff High Byte	16
74	66	42	Alternate Speed Curve Step 8	-	146			Function - Labor Chuff Low Byte	16
75	76	4C	Alternate Speed Curve Step 9	-	147			Function - Drift Chuff High Byte	17

User-Settable F-Function List

This feature allows you to take the 28 F-Functions that currently reside in each MTH Protosound3.0-equppied O-Gauge Engine and change the location of that function. For example: F13 is currently Coupler Slack and you'd like that placed down to F28 which is Cab Chatter. The below instructions explain how you can do this.

Note – When you set a particular F-Function to a numeric location you are overwriting that existing number's function. Further, you are leaving the location where the previous function was moved from empty, which means that F-Function no longer has any function associated with it.

In order to move the F-Functions around you will need to refer to the below table.

Note – The Function Identification number IS NOT the F Function number you'd use on your DCC handheld. It is used internally in the engine:

Function Identification Chart

Sounds	Function Identification
Bell	1
Brake Sounds	2
Cab Chatter	3
Clickety Clack	4
Coupler Close	5
Coupler Slack	6
Drift Chuff	7
Engine Sounds	8
Forward Signal	9
Crossing Signal	10
Horn	11
Idle Sequence 1	12
Idle Sequence 2	13
Idle Sequence 3	14
Idle Sequence 4	15
Labor Chuff	16
Master Volume	17
Short Horn	18
One Shot Doppler	19
Reverse Signal	20
Scripts	
Extended Shut Down	21
Extended Start Up	22
PFA	23
Start Up/Shut Down	24
Train Wreck	25
Trolley Manual Mode	26
Trolley Learn More	27
Trolley Auto Mode	28
Other Functions	
Feature Reset	29
Front Coupler	30
Front Pantograph Up/Down	31
Pantograph Auto/Manual	32
Rear Coupler	33
Rear Pantograph Up/Down	34
Rev Down	35
Rev Up	36
Smoke On/Off	37
Smoke Volume	38
Lights	
Lights	39

The above list includes ALL F functions that an MTH PS3 engine could have. You are free to change any of the above listed items to any F function position, 1-28. For example, if you your engine came from the factory without a smoke unit but you added one at a later date you could swap out any of the F functions, 1-28, for the Smoke On/Off and the Smoke Volume.

So, using the example above of moving F13 to F28 here are the steps:

1. Refer the MTH Supported CV table to see what CV the destination Function is assigned to. In doing so, you are looking only for the Low Byte CV location. In this case it's Cv170

2. Using your DCC system, bring up CV programming for Cv170

3. Now tell the engine which F-Function you want to write at CV170. So, looking at the Function ID table above you can see that Coupler Close is a value of 5

4. Using your DCC system, enter a value of 5 for CV170 and hit Enter. You have just re-assigned the Coupler Slack sound to F28 on your DCC controller. The engine will give you a two horn blast indication. Note – You've also left an empty location where Coupler Slack used to be (F13)

5. Now you can fill that location with whichever CV you'd like. For this example we are just going to move the Cab Chatter up to F13 (we're just swapping F13 and F28)

6. Since F13's Low Byte is CV140 then bring up CV programming for Cv140

7. Now tell the engine which F-Function you want to write at CV140. So, looking at the Function ID table above you can see that Cab Chatter is a value of 3

8. Using your DCC system, enter a value of 3 for CV140 and hit Enter. Your engine will give you a two horn blast indication

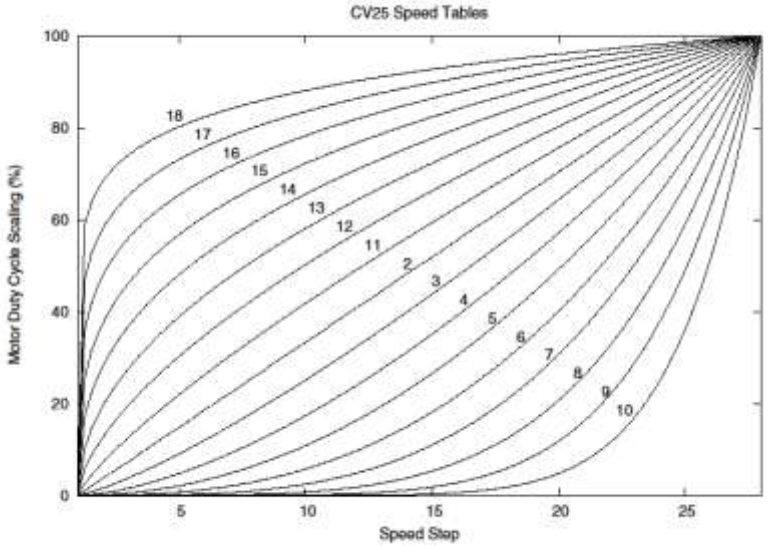
Custom Speed tables
Below is a table that shows the value to write to CV25 to achieve the desired speed curve. For example, if you would like to use speed curve 18 then:

1. Write a value of 1 to CV52 to enable PWM Mode

2. Write a value of 1 to bit 4 of Cv29

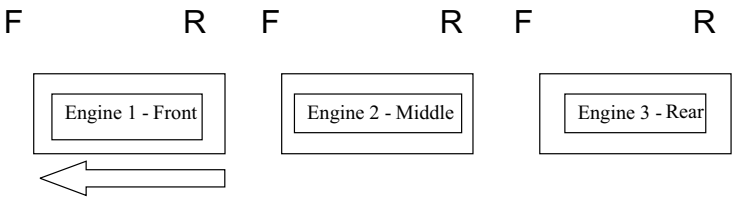
3. Write a value of 18 to CV25. Your engine will now use the speed curve #18 below

4. If you want to create your own speed table using CV's 67-94 then write a value of 0 or 1 to Cv25



Advanced Consisting
Advanced Consisting follows the NMRA standards. Any values assigned to CV's 21-24 are ignored once the consist is removed (CV19 set to 0).

? Setting the MSB (Bit 7) of CV19 tells the engine that it is facing reverse in the consist
? Setting CV21 and CV22 determine which F Functions the consist responds to
See diagram below for example



Normal Forward Direction of Travel

To set this consists up so that:

? The Headlight is ON in the Front engine when going Forward, OFF when the consist is in Reverse

? The Reverse light and headlight is OFF in the Rear engine when the consist is going Forward, headlight is ON, reverse light is OFF when the consist is in Reverse

? The Middle engine has no lights in either direction

Perform the following:

1. Build the consist using your DCC system per the DCC system's manufacturer's instructions. In many newer systems you have the ability to tell the system which engine is reversed. Remember the consist address you told the DCC system to be built at as you'll need to come back to that address to actually run the consist. The instructions assume only CV19 gets the consists address and nothing more
2. Call up the Front engine on your DCC handheld; address 1 in this example
3. Select CV22 and write a value of 1. This tells the engine that it's a forward facing engine and that you want F0 to control the FL function at the consist address. The engine will give you two horn blasts to announce that it received the CV change
4. Ensure F0 is deactivated at the Front engine's address. Most systems have a light bulb icon to indicate whether F0 is active or not. Ensure that it is OFF
5. Call up the Rear engine on your DCC handheld; address 3 in this example

Set CV19 to 128 + the value of your consist address

a. So, if your consist address is 4 you would add 128+4=132. You would write 132 to CV19. This tells the Rear engine that it's reversed in the consist. You will get two horn blasts to announce that it received the CV change. Some DCC systems may already do this for you but the instructions assume your system does not. If you are in doubt then go ahead and follow step 5 as it will do no harm

2. Set CV22 to a value of 2 to the Rear engine's address to tell the Rear engine that you want to control its FL control with the F0 button at the consist address. The engine will give you two horn blasts to announce that it received the CV change

3. Ensure F0 is deactivated at the Rear engine's address. Most systems have a light bulb icon to indicate whether F0 is active or not. Ensure that it is OFF

4. Call up the Middle engine on your DCC handheld; address 2 in this example

5. Ensure F5 and F0 are toggled OFF. You may have to toggle F5 on/off a couple times to get the lights in sync with the DCC command station. This will depend upon your DCC system

6. Call up the consist address (address 4 in this example)

7. Press the F0 button to ensure the FL is toggled on. Most systems have a light bulb icon to indicate whether F0 is active or not. Ensure that it is ON

Note – The convenient thing about setting up the consist as described above is that it allows you flexibility in the orientation of an engine in a consist; particularly the head and tail engines where the FL control is integral. For example, if you wanted to flip the Rear engine around and make it face forward in the consist all you'd have to do is go into the Rear engine's address (address 3 in the example) and clear bit 7 of CV19. In other words, just write the consist's address to CV19. The FL control will automatically understand what you've done so there is no need to go in and change CV22.

Below is a table that outlines which bits correspond to what F Functions F0, F9-F12 are used in a consist:

Bit (Decimal Value)	7 (128) Not Used	6 (64) Not Used	5 (32)	4 (16)	3 (8)	2 (4)	1 (2)	0 (1)
F Function	Not Used	Not Used	F12	F11	F10	F9	F0 (Engine Facing Rev)	F0 (Engine Facing Fwd)

Setting Up CV21 for a Consist

Cv21 allows you to set which F Functions you want the consist address to control. For example, you will likely want all of your MTH consist engines to respond to Start-Up/Shut Down (F3). Also, you'll likely want at your Front engine to respond to the Bell and Horn commands (F1 and F2, respectively) and the Front Coupler (F7 on most MTH models). Likewise, you'll want your Rear engine to respond to the Rear Coupler command (F8 on most MTH models).

Please refer to the table below to see which bits have what decimal value and which F Function they correspond to.

To do this:

1. Call up the Front engine on your DCC system
2. To set the Front engine to respond to the Bell (F1), Horn (F2), Start-Up/Shut Down (F3) and Front Coupler (F7) you will want to write a value of 71 to CV21. This is setting bits 0, 1, 2, and 6 ON.

a. CV21's bits are shown in the table below – the decimal value is shown in parenthesis:

Bit (Decimal Value)	7 (128)	6 (64)	5 (32)	4 (16)	3 (8)	2 (4)	1 (2)	0 (1)
F Function	F8	F7	F6	F5	F4	F3	F2	F1

NOTE - CV21 is ONLY used when you have some value other than 0 written to CV19. If CV19 = 0 then the values of CV21, CV22, CV23, and CV24 are not used

1. Call up your Middle engine (address 2 in the example)
2. Since you want to have the Middle engine respond to F3 only then write a value of 4 (CV21, bit 2 = ON)
3. Call up your Rear engine (address 3 in the example)
4. Since you want to have the Rear engine respond to the Start-Up/Shut Down (F3) and Rear Coupler (F8) functions you want to write a value of 132 to CV21

Your engines are now set up according to the example above.

You will note that there is no F0 in CV21. This is because that function (FL) is controlled by CV22. Please refer to the Advanced Consisting section for more information regarding Cv22.

Programming Track

Your MTH PS3.0-equipped HO engine can function on Programming Track outputs from DCC systems. Because each DCC system manufacturer's output capabilities on the Programming Track differ it is recommended that you use a DCC Programming Track Booster to perform functions on the programming track. Simply put – try to program or read back the address of an MTH engine on a programming track. If you can read/write the address then you won't need a Programming Track Booster. If your DCC system can't read/write then you will likely need a Programming Track booster. There are a few different manufacturers of these boosters. Your local dealer can provide you with more information on these boosters. MTH has used the DCC Specialties Power Pax with some success.
Note – An alternative to writing on a Programming Track is to simply Program on the Main (PoM). MTH engines support PoM to write any CV on the main. However, read back is not supported on the main. Check with your DCC system's manufacturer to see about any limitations they may have to PoM.

DCC Bit Value Decoder

Example Value (bit 7 -> bit 0) 11011001								
Bit (Decimal Value)	7(128)	6(64)	5(32)	4(16)	3(8)	2(4)	1(2)	0(1)
Binary Example	1(on)	1(on)	0(off)	1(on)	1(on)	0(off)	0(off)	1(on)
Decimal Value	128	64	0	16	8	0	0	1

So, in the above example you simply add up the values in the "Decimal Value" row – 128+64+0+16+8 +0+0+1 = 217. You would write 217 to the CV you were altering.

The above applies to any CV. Also, if you have a CV that already has a value assigned that you do not want to alter but need to make additions to it, for example CV29, you would simply add the additional bits you enabled to the existing value to obtain the new CV value.

For example, if you had a consist address (CV19) set to 5 and you wanted to alter this to show an engine reversed in the consist you would need to set bit 7 (decimal value = 128) for the engine you want to reverse. To do this - take 128 (the new bit you want to set) + 5 (the existing bit that you do not want to alter) = 133. You would then write a value of 133 to CV19.

Proto-Sound® 3.0 Conventional AC Operating Instructions

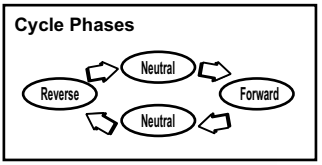
Activating Proto-Sound® 3.0 Conventional AC Mode Features

Throttle - To increase or decrease track voltage, and therefore train speed, turn the throttle control knob. Turning clockwise will increase voltage and speed, while turning counterclockwise will decrease voltage and speed. The engine will maintain the speed you set after you release the throttle until you turn it again to change the voltage and speed.

Bell - To sound the bell, in an engine equipped with a bell firmly press and release the Bell button. To turn the bell off, press and release the Bell button again. The bell will continue to ring from the time you turn it on until you press and release the button again to turn it off.

Horn/Whistle - To sound the whistle, firmly press the Horn/Whistle button. The whistle will sound for as long as you continue to depress the button. It will stop when you release the button.

Direction - Your train is programmed to start in neutral. The train will always cycle neutral-forward-neutral-reverse with each press and release of the direction button. The engine is programmed to restart in neutral each time the track voltage is turned off for 25 seconds or more.



Manual Volume Control

To adjust the volume of all sounds made by this engine, turn the master volume control knob located under the left water hatch on the tender deck clockwise to increase the volume and counter-clockwise to decrease the volume.

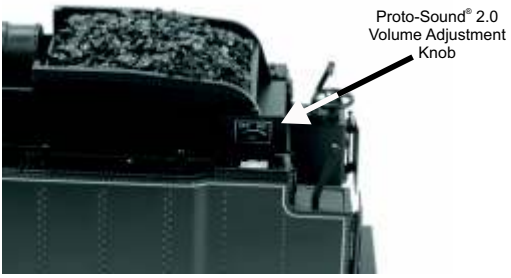


Figure 10: Manually Adjusting the Volume

Proto-Sound® 3.0 features are activated by sequences of Bell and Horn button pushes described below. Please read the full descriptions of each feature before using it. To use these buttons to activate features rather than to blow the horn or ring the bell, you should tap the buttons very quickly with a ½-second pause between button presses. You may need to practice your timing to make this work smoothly.

Timing Chart				
Press Horn Short & Firm	½ Sec. Pause	Press Bell Short & Firm	½ Sec. Pause	Press Bell Short & Firm
Total Time Lapse: 1 ½ Seconds				

Feature to Be Activated	Button Code:
Freight Yard or Passenger Station Sounds	1 Bell, 2 Horn/Whistles
Fire the Rear Coupler	1 Bell, 3 Horn/Whistles
Fire the Front Coupler	1 Bell, 4 Horn/Whistles
Speed Control On/Off	1 Horn/Whistle, 2 Bells (from Neutral only)
Lock into a Direction	1 Horn/Whistle, 3 Bells
Reset to Factory Defaults	1 Horn/Whistle, 5 Bells (from Neutral only)

Passenger/ Station Announcements (PSA)/ Freight Yard Sounds (FYS)

Your engine is equipped with a sound package of passenger station announcements that you can play when you pull into a station. Each sequence described below will play as long as it is left on, randomly generating sounds, but be sure to allow approximately 30 seconds between the button pushes described below to allow the PSA/FYS sufficient time to run through each sequence.

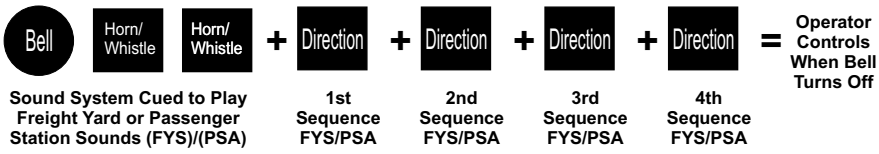
•To cue the sound system to play the PSA/FYS, quickly but firmly tap the Bell button once followed by 2 quick taps of the Horn button while the engine is moving. Tap the buttons quickly but allow approximately ½ second between each press.

• Press the Direction button once to stop the engine. This will trigger the first sequence of PSA/FYS. The reverse unit is temporarily disabled so that the train will not move as you use the Direction button to trigger the sounds, and Proto-Sound 2.0 has disabled operator control over the Horn and Bell buttons until the full PSA/FYS. sequence is complete.

•After waiting about 30 seconds for that sequence to run, press the Direction button again to trigger the second sequence of PSA/FYS.

•After about 30 seconds, press the Direction button again to trigger the third PSA/FYS sequence.

•Again, after allowing about 30 seconds for that sequence to run, press the Direction button one more time to trigger the fourth and final PSA/FYS sequence. The PSA/FYS will continue, and within a few seconds, the engine and bell will start and move out on its own at the current throttle setting, in the same direction it was traveling when you began the sequence. Once the bell turns off, the operator regains control of the transformer's bell and Horn buttons and can ring the bell or blow the Horn as usual.



Tips on Using PSA/FYS

•You can terminate PSA/FYS at any time by turning off power to the track for 15 seconds.

•You do not have to be in Forward to use PSA/FYS. At the conclusion of the full sequence, the train will pull away from the station in whatever direction you were going when you activated the feature.

•You can use PSA/FYS even if you are double-heading with another engine. If the second engine is not equipped with Proto-Sound® 2.0, you must remember not to leave the throttle at a high voltage level once you have stopped the engine to run the PSA/FYS. Otherwise, the engine without PSA/FYS will begin vibrating on the track as its motors strain to move the train, since they cannot be automatically disabled during the PSA cycle (or if an original Proto-Sound® engine, PSA/FYS are triggered differently and that engine's motor-disable feature will not be active when you run PSA/FYS in Proto-Sound® 3.0).

•PSA/FYS can be triggered from Neutral. It will operate the same as if triggered while in motion except that, at the conclusion of the PSA/FYS, the engine will depart in the next direction of travel, as opposed to the direction it was traveling before entering Neutral.

Proto-Coupler® Operation

This locomotive is equipped with one or more coil-wound Proto-Couplers for remote uncoupling action. Because Proto-Couplers are controlled through the Proto-Sound® 3.0 microprocessor, they do not require an uncoupling track section or modification to your layout to function. You can fire a coupler from neutral or while in motion. Use the code shown below (and in the chart on p. 31) to fire the coupler(s).

Rear Coupler:

To fire the rear coupler, quickly tap the Bell button once followed by three quick taps of the Horn button, allowing approximately ½ second to lapse between each quick button press. The sound of the liftbar and air line depletion will play, and the knuckle will be released.

Front Coupler:
To fire the front coupler (if your engine has one), quickly tap the Bell button once followed by four quick taps of the Horn button, allowing approximately ½ second to lapse between each quick button press. The sound of the liftbar and air line depletion will play, and the knuckle will be released.

Speed Control

M.T.H. engines equipped with Proto-Sound 3.0 have speed control capabilities that allow the engine to maintain a constant speed up and down grades and around curves, much like an automobile cruise control. You can add or drop cars on the run, and the engine will maintain the speed you set.

While the engine is programmed to start with the speed control feature activated, you can opt to turn it off. This means the engine's speed will fall as it labors up a hill and increase as it travels downward. It is also affected by the addition or releasing of cars while on the run. Because the engine will run more slowly at a given throttle voltage when speed control is on than when it is off, you should adjust the throttle to a lower power level for operation with speed control off to avoid high-speed derailments. When speed control is off, the volume will drop to allow for better low voltage operation.

To turn speed control on and off, put the engine in neutral, then quickly tap the transformer's Horn button one time then quickly tap the Bell button two times, allowing approximately ½ second to lapse between each quick button press. Two horn blasts will indicate that the engine has made the change. Repeat the 1 horn, 2 bells code to return it to the other condition. You will want to do this during the initial neutral upon start-up if you ever couple this engine to another engine that is not equipped with speed control to avoid damaging the motors in either engine. Each time you shut down the engine completely, it will automatically turn speed control on.

Locking Locomotive Into A Direction

You can lock your engine into a direction (forward, neutral, or reverse) so that it will not change directions. To do this, put the engine into the direction you want (or into neutral to lock it into neutral), run it at a very slow crawl (as slowly as it will move without halting), and quickly but firmly tap the Horn button once followed by three quick taps of the Bell button, allowing approximately ½ second to lapse between each quick button press. Two horn blasts will indicate that the engine has made the change. The engine will not change direction (including going into neutral) until you repeat the 1 horn, 3 bells code to return the engine to its normal condition, even if the engine is kept without power for extended periods of time.

Reset to Factory Default

To override the settings you currently have assigned to the engine and reset it to its factory defaults, while in Neutral tap the Horn button quickly once, followed by five quick taps of the Bell button, allowing approximately ½ second to lapse between each quick button press. Two horn blasts will indicate that the engine has made the change.

Automatic Sound Effects

Certain Proto-Sound® 3.0 sound effects automatically play in programmed conventional mode conditions:

- Squealing Brakes play any time the engine's speed decreases rapidly.
- Cab Chatter plays at random intervals when the engine idles in neutral.
- Engine Start-up and Shut-down sounds play when the engine is initially powered on or is powered off for five seconds or more.

Maintenance

Lubricating and Greasing Instructions

The engine should be well oiled and greased in order to run properly. You should regularly lubricate all side rods, linkage components and pickup rollers to prevent them from squeaking. Use light household oil and follow the lubrication points marked "L" in Fig. 7. Do not over-oil. Use only a drop or two on each pivot point.

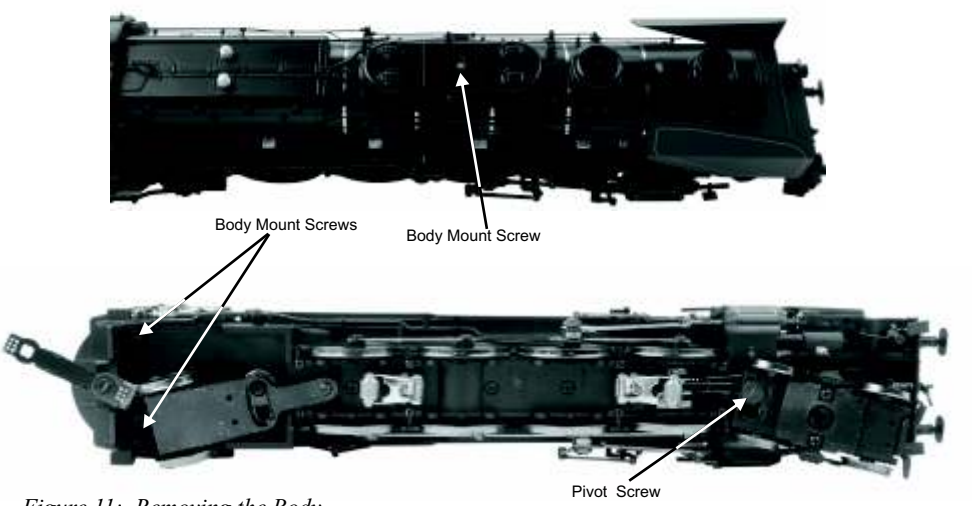


Figure 11: Removing the Body

The locomotive's internal gearing was greased at the factory and should not need additional grease until after 50 hours of operation or one year, whichever comes first. To access the gear box and axles, do the following:

1. Turn the engine upside down.

2. Remove the Phillips screws (marked "GREASE"). One is located directly under the front pick up roller. The other is located in the center of the drive wheels.

3. Use a grease tube dispenser to put a small amount (approx. 1-2 ml.) of lithium-based grease into the gearbox and axles.

4. Replace the screws.

You should also grease the leading and trailing locomotive truck tongues to enhance their ability to slide on the chassis. Follow the grease points shown on Fig. 12.

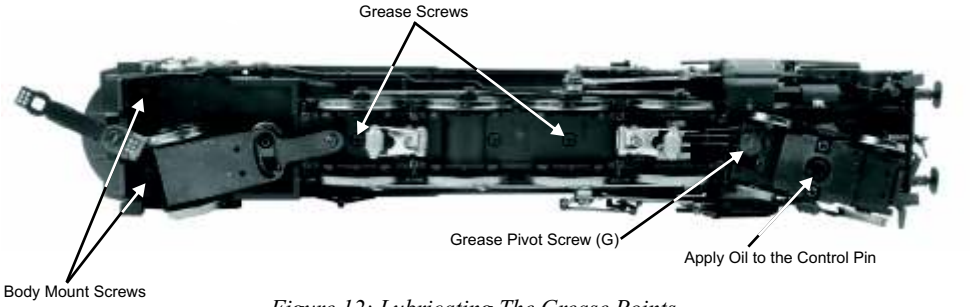


Figure 12: Lubricating The Grease Points

Cleaning the Wheels, Tires and Track

Periodically check the locomotive wheels and pickups for dirt and buildup, which can cause poor electrical contact and traction as well as prematurely wear out the neoprene traction tires.

Wheels and tires can be cleaned using denatured (not rubbing) alcohol applied with a cotton swab.

Tire Traction Replacement Instructions

(3-Rail Version Only)

Your 3-rail locomotive is equipped with two neoprene rubber traction tires on the rear set of flanged drivers. While these tires are extremely durable, you may need to replace them at some point.

1. Remove the side rods from the wheels in order to slip the new tire over the grooved drive wheel. Make sure to note the position of all rods before removing.

2. Make sure the old tire has been completely removed from the groove in the drive wheel, using a razor blade or small flathead screwdriver to pry away any remains.

3. Slip the new tire onto the wheel. You may find it useful to use two small flathead screwdrivers to stretch the tire over the wheel.

4. If you twist the tire while stretching it over the wheel, you will need to remove and reinstall the tire. Otherwise your engine will wobble while operating.

5. Make sure the tire is fully seated inside the groove. Use a razor blade to trim away any excess tire that doesn't seat itself inside the groove properly.

6. Reinstall the side rods in the same positions as noted. Failure to align rods may cause binding or damage to the drive system.

One set of replacement tires is packaged with your model. Additional sets are available directly from the M.T.H. Parts Department (phone: 410-381-2580; e-mail: parts@mth-railking.com; mail: 7020 Columbia Gateway Drive, Columbia MD 21046-1532).

ProtoSmoke® Unit Operation

This Premier steam locomotive contains a self-powered smoke unit that outputs smoke through the smokestack on the roof of the engine. The smoke unit is essentially a small heating element and wick that soaks up and then heats a mineral oil-based fluid that emits a harmless smoke. The smoke is then forced out of the stack by a small electric fan. Smoke volume is controlled by the Proto-Sound® 3.0 system.

With a few easy maintenance steps, you should enjoy trouble-free smoke unit operation for years.

When preparing to run this engine, add 10-15 drops of smoke fluid through the smokestack (See figure 16). We recommend M.T.H. ProtoSmoke, Seuthe, LGB, or LVTS fluids. Do not overfill the unit or the fluid may leak out and coat the interior engine components.

If you choose not to add the fluid (or have already added the fluid but choose to run smoke-free), turn off the smoke unit switch located under the water hatch on the right side of the tender (See figure 17). **Failure either to add fluid to the unit or to turn it off may damage the smoke unit heating element and/or wick material.**

When the smoke output while running the engine begins to diminish, add another 10-15 drops of smoke fluid or turn the smoke unit off.

When storing the unit for long periods of time, you may want to add about 15 drops of fluid to prevent the wick from drying out.

After removing the engine from storage, add another 20 drops of fluid, letting the wick soak up the fluid for 15 minutes prior to operation.

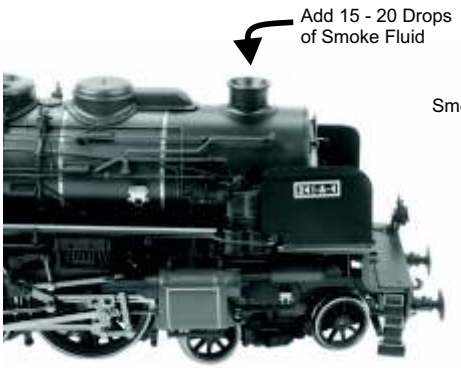


Figure 16

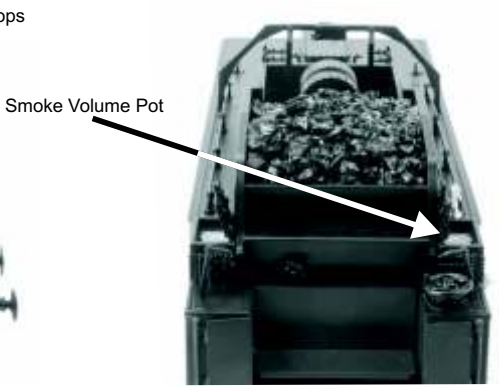


Figure 17

If you experience poor or no smoke output when the smoke unit is on and has fluid, check the wick to see if it has become hard, blackened, and unabsorbent around the heating element. To remove the smoke unit you will first have to remove the boiler shell (by removing the body mounting screws shown in Fig. 11 on pg. 20).

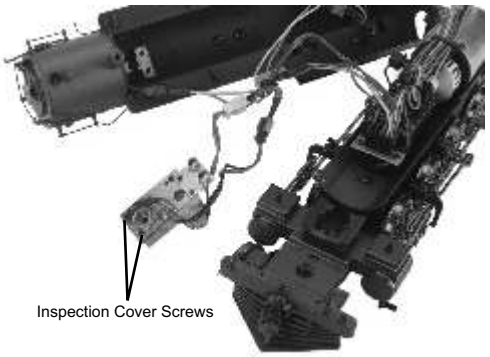


Figure 18

1. Once the boiler has been removed, remove the inspection cover (See figure 18). Inspect the wick; if it is darkly discolored and hard, it should be replaced.

Replacement parts and wick replacement instructions are available directly from the M.T.H. Parts Department phone: 410-381-2580; e-mail: parts@mth-railking.commail: 7020 Columbia Gateway Drive, Columbia MD 21046-1532

Troubleshooting Proto-Sound® 3.0 Problems

Although Proto-Sound 3.0 has been designed and engineered for ease of use, you may have some questions during initial operation. The following table should answer most questions. If your problem cannot be resolved with this table, contact M.T.H. for assistance (telephone: 410-381-2580; fax: 410-423-0009; service@mth-railking.com, 7020 Columbia Gateway Drive, Columbia MD 21046-1532).

Starting Up	Remedy
When I first turn the power on, the engine will not begin to run.	This is normal behavior. To prevent accidental high-speed start-ups, Proto-Sound® 3.0 is programmed to start up in neutral anytime track power has been turned off for several seconds. See the "Basic Operation" section for more details.
The engine will not start after I press the Direction button.	You may not be sending enough power to the track to power the engine. Rotate throttle clockwise to increase track power.
Horn	**Remedy**
I can't get the horn to blow when I press the Horn button.	You may be pressing the button too quickly. Try pressing the Horn button more slowly, taking approximately one full second to fully depress the button.
Bell	**Remedy**
I can't get the bell to ring when I press the bell button.	You may be pressing the button too quickly. Try pressing the bell button more slowly, taking approximately one full second to fully depress the button.
Coupler	**Remedy**
When I try to fire the coupler, PSA/FYS starts.	You are waiting too long between Horn button presses. See the timing instructions located at the beginning of the "Proto-Sound 2.0 Operating Instructions" section.
The Proto-Coupler won't let the engine uncouple on the fly.	Try lubricating the coupler knuckle and rivet with a dry graphite lubricant.
The coupler does not fire or stay coupled.	The coupler needs to be cleaned. Wipe with denatured alcohol (not rubbing alcohol) and let dry.
The rear coupler does not fire, but coupler sounds play.	Check position of Auxiliary Proto-Coupler Control Switch. Switch Should be in the “OFF” position for the rear coupler to fire.
Cab Chatter	**Remedy**
Sometimes the Cab Chatter sounds don't play.	Cab Chatter plays only in neutral at random intervals.

Lock-out	Remedy
I can't get the engine to run after I power up the transformer. It sits still with the diesel and compressor sounds running. The engine won't lock into forward, neutral, or reverse.	The engine maybe locked into the neutral position. Follow the procedure in the "Lock into a Direction" section to unlock the engine's direction. Engine speed must be below 10 scale mph (approx. 10 volts or less in conventional mode).
Volume	**Remedy**
The sounds seem distorted, especially when the Horn or bell is activated.	Proto-Sound® 3.0 volume is set too high. Turn the volume control knob on the bottom of the chassis counter-clockwise to reduce the volume.
No Sound	Volume is set too low, adjust volume control knob on the bottom of the chassis clockwise to increase the volume or check connector to speaker.
PSA/FYS	**Remedy**
Once in PSA/FYS, the engine doesn't go into reverse.	So that PSA/FYS effects can be as realistic as possible, Proto-Sound® 3.0 disables the reversing unit whenever PSA/FYS is enabled. This way the engine remains still at its stop as the operator cycles through the PSA/FYS sequences.
When the PSA/FYS enters its last sequence the bell automatically comes on	PSA/FYS is programmed to start ringing the bell at that point. After approximately 12 seconds, it will automatically turn off.
When PSA/FYS is enabled, pressing the whistle and bell has no effect	Because PSA/FYS must control various effects in each sequence, Proto-Sound® 3.0 takes control of these sound effects until you exit PSA/FYS
I push the direction button but the next sound clip in the sequence does not play or the engine does not come out of PSA/FYS after fourth press of the direction button.	Each PSA/FYS clip must play for aprox. 30 seconds before PSA/FYS will advance to the next step in the PSA/FYS cycle. Wait at least 30 seconds in each PSA/FYS sound clip before pressing the direction button.

Transformer Compatibility and Wiring Chart

Proto-Sound® 3.0 is designed to work with most standard AC transformers. The chart below lists the many compatible transformers. Note that many of the operational commands described in these instructions require a bell button, so if your transformer does not have its own bell button, you should consider adding one to get the full benefit of the system. In addition, the chart details how the terminals on these transformers should be attached to your layout.

Transformer Model	Center Rail	Outside Rail	Min/Max. Voltage	Power Rating	Transformer Type
MTH Z-500	Red Terminal	Black Terminal	0-18v	50-Watt	Electronic
MTH Z-750	Red Terminal	Black Terminal	0-21v	75-Watt	Electronic
MTH Z-1000	Red Terminal	Black Terminal	0-14v 0-18v	80-Watt 100-Watt	Electronic
MTH Z-4000	Red Terminal	Black Terminal	0-22v	390-Watt	Electronic
Lionel 1032	U	A	5-16v	90-Watt	Standard
Lionel 1032M	U	A	5-16v	90-Watt	Standard
Lionel 1033	U	A	5-16v	90-Watt	Standard
Lionel 1043	U	A	5-16v	90-Watt	Standard
Lionel 1043M	U	A	5-16v	90-Watt	Standard
Lionel 1044	U	A	5-16v	90-Watt	Standard
Lionel 1053	U	A	8-17v	60-Watt	Standard
Lionel 1063	U	A	8-17v	60-Watt	Standard
All-Trol	Left Terminal	Right Terminal	0-24v	300-Watt	Electronic
Dallee Hostler	Left Terminal	Right Terminal			Electronic
Lionel LW	A	U	8-18v	75-Watt	Standard
Lionel KW	A or B	U	6-20v	190-Watt	Standard
Lionel MW	Outside Track Terminal	Inside Track Terminal	5-16v	50V.A.	Electronic
Lionel RS-1	Red Terminal	Black Terminal	0-18v	50V.A.	Electronic
Lionel RW	U	A	9-19v	110-Watt	Standard
Lionel SW	U	A	Unknown	130-Watt	Standard
Lionel TW	U	A	8-18v	175-Watt	Standard
Lionel ZW	A,B,C or D	U	8-20v	275-Watt	Standard
Lionel Post-War Celebration Series ZW	A,B,C or D	Common	0-20v	135/190 Watt	Electronic

*Conventional Mode Only

DC Power Supply Chart

RECOMMENDED DC TRANSFORMERS				
Transformer Model	**Min/Max. Voltage**	**Power Rating**	**Notes On Use**	**Transformer Type**
MRC 6200	**0-18.5v**	**60-Watt**	Not Recommended For #70-3001-1 J3a	**Electronic**
MRC Controlmaster 20	**0-20v**	**100-Watt**		**Electronic**
PH Hobbies PS5	**0-20v**	**100-Watt**		**Electronic**
PH Hobbies PS10G	**0-20v**	**180-Watt**		**Electronic**
Bridgeworks Magnum 15	**0-24v ***	**300-Watt**		**Electronic**
Bridgeworks Magnum 200	**0-24v ***	**300-Watt**		**Electronic**
Bridgeworks Magnum 400	**0-24v ***	**300-Watt**		**Electronic**
Bridgeworks Magnum 1000	**0-24v ***	**300-Watt**		**Electronic**
LGB Jumbo #50101	**0-24v ***	**240-Watt**	Not recommended for #70-3001-1 J3a	**Electronic**

* Use 22 volts maximum track voltage when operating a MTH locomotive equipped with Proto-Sound, Loco-Sound, or Proto-Sound 2.0

Additional Features Accessible With The DCS - Digital Command System - Remote Control System

(Additional equipment required)

While conventional mode operation of a Proto-Sound® 3.0 engine yields wonderfully realistic sound and several train control features, command mode operation allows the user to access a world of command functions never before accessible to O Gauge railroaders. With the addition of the DCS Remote Control System (including a DCS remote handheld and Track Interface Unit) users gain many advanced features, including:

- •DCS Proto-Speed Control - Establishes desired locomotive speed in scale miles per hour increments via a thumbwheel control and allows operator to set maximum speed and acceleration/deceleration rates
- •ProtoSmoke® Variable Output Control - Controls how much smoke each engine outputs and matches smoke to locomotive speed
- •Locomotive Lighting Control - Controls locomotive headlights, marker and interior lights, beacon lights, ditch lights, and MARS lights
- •Emergency Stop - Single button push stops all Proto-Sound® 3.0 trains but does not turn off the power
- •One Touch Global Mute/UnMute - Single button mutes or unmutes all DCS-controlled locomotives' user-defined actions, including sound, lights, and smoke
- •Proto-Dispatch Operation-Public Address-like feature allows users to speak through locomotive speaker during operation
- •Proto-Cast - Allows users to play audio recordings through locomotive speaker during operation
- •Proto-Doppler Sound Effects Set Up - Users can configure locomotive for Doppler Operation, including setting distance points for Doppler start, repeat, and stop modes
- •Independent Volume Control of Engine Sounds, Bell, Horn & Whistle for each Locomotive
- •Control up to 50 different DCS-Equipped Locomotives at one time with multiple TIUs
- •Proto-Effects™ Set Up - User can select individual Proto-Effects™ operations to be active or inactive, including cab chatter, train wreck sounds, coupler sounds, and wheel clickety-clack sounds
- •Direction Control Set Up - User can set initial individual start-up direction (start in forward or reverse) for double-heading operations
- •Locomotive Consist Set-up - User can determine locomotive values for consist make-ups, allowing multiple locomotives belonging to a consist to operate together

Service & Warranty Information

How to Get Service Under the Terms of the Limited One-Year Warranty

When you suspect an item is defective, please check the operator's manual for standard operation and trouble-shooting techniques that may correct the problem. Additional information may be found on the M.T.H. Website. Should you still require service, follow the instructions below to obtain warranty service.

First, e-mail, write, call or fax a M.T.H. Authorized Service Center (ASC) in your area to obtain Repair Authorization. You can find the list of ASCs on the M.T.H. Website, www.mth-railking.com. Authorized Service Centers are required to make warranty repairs on items sold *only* from that store; all other repairs may-- or may not be done at the store's own discretion. If you did not purchase the item directly from the ASC, you will need to select a National Authorized Service Center (NASC). These centers are compensated by M.T.H. to perform warranty service for any customer whose repair qualifies for warranty service. A list of NASC retailers can be located on the M.T.H. Website or by calling 410-381-2580. Should the warranty no longer apply, you may choose either an ASC or NASC retailer to service your M.T.H. Product. A reasonable service fee will be charged.

CAUTION: Make sure the product is packed in its original factory packaging including its foam and plastic wrapping material to prevent damage to the merchandise. There is no need to return the entire set if only one of the components is in need of repair *unless otherwise instructed by the Service Center*. **The shipment must be prepaid and we recommend that it be insured. A cover letter including your name, address, daytime phone number, e-mail address (if available), Return Authorization number (if required by the service center, a copy of your sales receipt and a full description of the problem must be included to facilitate the repairs. Please include the description regardless of whether you discussed the problem with a service technician when contacting the Service Center for your Return Authorization.**

Please make sure you have followed the instructions carefully before returning any merchandise for service. Authorized M.T.H. Service Centers are independently owned and operated and are not agents or representatives of M.T.H. Electric Trains. M.T.H. assumes no responsibility, financial or otherwise, for material left in their possession, or work done, by privately owned M.T.H. Authorized Service Centers.
If you need assistance at any time email MTH Service at service@mth-railking.com, or call 410 381-2580.

Limited One-Year Warranty

All M.T.H. products purchased from an Authorized M.T.H. Retailer are covered by this warranty. See our Website **www.mthtrains.com** to identify an M.T.H. Retailer near you.

M.T.H. products are warrantied for one year from the date of purchase against defects in material or workmanship, excluding wear items such as light bulbs, pick-up rollers, batteries, smoke unit wicks, and traction tires. We will repair, replace, or credit (at our option) the defective part without charge for the parts or labor, if the item is returned to an M.T.H. Authorized Service Center (ASC) or M.T.H. National Authorized Service Center (NASC) within one year of the original date of purchase. This warranty does not cover damages caused by improper care, handling, or use. Transportation costs incurred by the customer are not covered under this warranty.

Items sent for repair must be accompanied by a return authorization number, a description of the problem, and **a copy of the original sales receipt from an Authorized M.T.H. Train Merchant**, which gives the date of purchase. If you are sending this product to an Authorized Service Center, contact that Center for their return authorization.

This warranty gives you specific legal rights, and you may have other rights that vary from state to state. Specific questions regarding the warranty may be forwarded to M.T.H. Directly.

Service Department:
M.T.H. Electric Trains
7020 Columbia Gateway Drive
.Columbia MD 21046-1532